

What is claimed is:

1. A portable communication system for use by a user with a communication apparatus having an audio port, the system comprising:

5 an infrared transmitter apparatus, wherein the infrared transmitter apparatus comprises:

at least one audio port configured to receive an audio signal representative of received audio input from the communication apparatus,

at least one infrared light emitting device,

10 modulation circuitry operable to convert the audio signal to one or more constant width electrical pulses to drive the infrared light emitting device to transmit one or more corresponding constant width infrared pulses,

15 a microphone coupled to the at least one audio port of the infrared transmitter apparatus and operable to generate an audio signal from received sound input of the user, wherein the audio signal generated from received sound input of the user is provided to the audio port of the communication apparatus via the audio port of the infrared transmitter apparatus, and

20 a transmitter housing enclosing the modulation circuitry and the microphone and upon which the at least one infrared light emitting device is mounted, wherein the transmitter housing is of a size smaller than the communication apparatus and configured to be removably coupled onto the communication apparatus; and

an infrared receiver apparatus, wherein the infrared receiver apparatus comprises:

25 an infrared light detection device to detect the one or more corresponding constant width infrared pulses and generate one or more electric signals representative of the detected infrared pulses,

a speaker,

demodulation circuitry operable to convert the one or more electric signals representative of the detected infrared pulses to an audio signal to power the speaker to produce a sound output, and

5 a receiver housing enclosing the speaker and the demodulation circuitry and upon which the infrared light detection device is mounted, wherein the receiver housing is formed to be self-supported by the ear of the user.

10 2. The system of claim 1, wherein the microphone is coupled to the at least one audio port of the infrared transmitter apparatus via an amplification circuit to provide the audio signal with a gain.

3. The system of claim 2, wherein the gain is in the range of 2 to 20.

15 4. The system of claim 1, wherein the transmitter housing comprises means for removably attaching the transmitter housing to the phone apparatus.

20 5. The system of claim 4, wherein the transmitter housing is removably coupled onto the communication apparatus by a two faced adhering system.

6. The system of claim 1, wherein the receiver housing comprises an in the ear receiver housing securable within the concha of the ear.

25 7. The system of claim 1, wherein the receiver housing comprises a behind the ear receiver housing securable by the pinna of the ear.

30 8. The system of claim 1, wherein the at least one audio port of the transmitter apparatus configured to receive an audio signal representative of received audio input from the communication apparatus comprises an audio port configured for wired connection to the audio port of the communication apparatus.

9. The system of claim 8, wherein the communication apparatus is a phone apparatus having a microphone/speaker audio port, and further wherein the audio port of the transmitter apparatus is configured for wired connection to the microphone/speaker audio port by a cord/plug connector apparatus.

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10. The system of claim 1, wherein the modulation circuitry comprises:  
pulse width modulation circuitry to convert the audio signal using a carrier signal to one or more width modulated pulses, wherein the width of the one or more pulses is varied as a function of the audio signal;

10 an edge detect circuit to detect the edges of the one or more width modulated pulses and generate constant width pulses based on the detected edges; and

a pulse driver circuit to drive the infrared light emitting device.

11. The system of claim 10, wherein the modulation circuitry comprises voice  
15 activated power up circuitry.

12. The system of claim 1, wherein demodulation circuitry comprises:  
pulse detection circuitry to convert the one or more electrical signals  
representative of the detected infrared pulses to one or more constant width pulses  
20 based thereon;

pulse width convertor circuitry to convert the one or more constant width pulses to one or more width modulated pulses; and

pulse width demodulation circuitry to convert the one or more width modulated pulses to an audio signal for application to the speaker.

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13. The system of claim 12, wherein the demodulation circuitry comprises at least amplification circuitry always operable in power-on idle mode when battery devices are connected for operation of the infrared receiver apparatus.

14. The system of claim 1, wherein the size of the transmitter housing comprises a volume less than about 5 cm<sup>3</sup>.

15. The system of claim 1, wherein the transmitter housing is configured to be  
5 removably coupled to a removable battery apparatus.

16. The system of claim 15, wherein the removable battery apparatus is  
configured to receive at least one of button type batteries and cylindrical alkaline  
batteries.

17. A portable transmitter apparatus for use by a user with a communication  
apparatus having an audio port, the apparatus comprising:  
10 at least one audio port configured to receive an audio signal representative of  
received audio input from the communication apparatus;  
15 at least one infrared light emitting device;  
modulation circuitry operable to convert the audio signal to one or more  
constant width electrical pulses to drive the infrared light emitting device to transmit  
one or more corresponding constant width infrared pulses;  
20 a microphone coupled to the at least one audio port of the transmitter  
apparatus and operable to generate an audio signal from received sound input of the  
user, wherein the audio signal generated from received sound input of the user is  
provided to the audio port of the communication apparatus via the audio port of the  
transmitter apparatus; and  
25 a transmitter housing enclosing the modulation circuitry and the microphone  
and upon which the at least one infrared light emitting device is mounted, wherein  
the transmitter housing is of a size smaller than the communication apparatus and  
configured to be removably coupled onto the communication apparatus.

18. The apparatus of claim 17, wherein the microphone is coupled to the at least one audio port of the transmitter apparatus via an amplification circuit to provide the audio signal with a gain.
- 5 19. The apparatus of claim 18, wherein the gain is in the range of 2 to 20.
20. The apparatus of claim 17, wherein the transmitter housing comprises means for removably attaching the transmitter housing to a phone apparatus.
- 10 21. The apparatus of claim 20, wherein the transmitter housing is removably coupled onto the communication apparatus by a two faced adhering system.
22. The apparatus of claim 17, wherein the modulation circuitry comprises:  
pulse width modulation circuitry to convert the audio signal using a carrier  
15 signal to one or more width modulated pulses, wherein the width of the one or more pulses is varied as a function of the audio signal;  
an edge detect circuit to detect the edges of the one or more width modulated pulses and generating constant width pulses based on the detected edges; and  
a pulse driver circuit to drive the infrared light emitting device.
- 20 23. The apparatus of claim 22, wherein the modulation circuitry comprises voice activated power up circuitry.
24. The apparatus of claim 17, wherein the at least one audio port of the  
25 transmitter apparatus configured to receive an audio signal representative of received audio input from the communication apparatus comprises an audio port configured for wired connection to the audio port of the communication apparatus.
25. The apparatus of claim 24, wherein the communication apparatus is a phone  
30 apparatus having a microphone/speaker audio port, and further wherein the audio

port of the transmitter apparatus is configured for wired connection to the microphone/speaker audio port by a cord/plug connector apparatus.

26. The apparatus of claim 17, wherein the size of the transmitter housing comprises a volume less than about 5 cm<sup>3</sup>.

27. The apparatus of claim 17, wherein the transmitter housing is configured to be removably coupled to a removable battery apparatus.

28. The apparatus of claim 27, wherein the removable battery apparatus is configured to receive at least one of button type batteries and cylindrical alkaline batteries.

29. A method of using a portable communication system with a phone apparatus having an audio port, the method comprising:

providing a removable transmitter, wherein the removable transmitter comprises:

at least one audio port configured to receive an audio signal representative of received audio input from the communication apparatus,

a transmitter device,

modulation circuitry operable to convert the audio signal to one or more electrical pulses to drive the transmitter device to transmit signals representative of the audio signal,

a microphone coupled to the at least one audio port of the removable transmitter and operable to generate an audio signal from received sound input of a user, wherein the audio signal generated from received sound input of the user is provided to the audio port of the communication apparatus via the audio port of the removable transmitter, and

a transmitter housing enclosing at least the modulation circuitry and the microphone; and

securing the removable transmitter onto the phone apparatus, wherein the transmitter housing of the removable transmitter is of a size smaller than the phone apparatus.

5        30.     The method of claim 29, wherein the size of the transmitter housing comprises a volume less than about 5 cm<sup>3</sup>.

10       31.     The method of claim 29, wherein the transmitter housing is configured to be removably coupled to a removable battery apparatus, and further wherein the method comprises:

             providing the removable battery apparatus; and

             coupling the removable battery apparatus to the transmitter housing when the transmitter housing is secured onto the phone apparatus.

15       32.     The method of claim 29, wherein providing the removable transmitter comprises providing a removable infrared transmitter, wherein the removable infrared transmitter comprises at least one infrared light emitting device mounted on the transmitter housing, and further wherein the modulation circuitry is operable to convert the audio signal to one or more electrical pulses to drive the infrared light  
20       emitting device to transmit one or more corresponding infrared pulses.

25       33.     The method of claim 29, wherein securing the removable transmitter to the phone apparatus comprises using a two faced adhering system to attach the removable transmitter to the phone apparatus.

34.     The method of claim 29, wherein the method further comprises:  
             detaching the removable transmitter from the phone apparatus; and  
             securing the removable transmitter to a different phone apparatus.

35. A portable communication system for use by a user with a communication apparatus having an audio port, the system comprising:

a transmitter apparatus, wherein the transmitter apparatus comprises:

at least one audio port configured to receive an audio signal

representative of received audio input from the communication apparatus,

modulation circuitry operable to convert the audio signal to one or more constant width electrical pulses to drive a transmitter to transmit one or more corresponding constant width pulses,

a microphone coupled to the at least one audio port of the transmitter apparatus and operable to generate an audio signal from received sound input of the user, wherein the audio signal generated from received sound input of the user is provided to the audio port of the communication apparatus via the audio port of the transmitter apparatus, and

a transmitter housing enclosing the modulation circuitry and the microphone, wherein the transmitter housing is of a size smaller than the communication apparatus and configured to be removably coupled onto the communication apparatus; and

a receiver apparatus operable for communication with the transmitter apparatus, wherein the receiver apparatus comprises:

a detection device to detect the one or more corresponding constant width pulses and generate one or more electric signals representative of the detected pulses,

a speaker,

demodulation circuitry operable to convert the one or more electric signals representative of the detected pulses to an audio signal to power the speaker to produce a sound output, and

a receiver housing enclosing at least the speaker and the demodulation circuitry, wherein the receiver housing is formed to be self-supported by the ear of the user.



36. The system of claim 35, wherein the microphone is coupled to the at least one audio port of the transmitter apparatus via an amplification circuit to provide the audio signal with a gain.

5 37. The system of claim 36, wherein the gain is in the range of 2 to 20.

38. The system of claim 35, wherein the transmitter housing comprises means for removably attaching the transmitter housing to the communication apparatus.

10 39. The system of claim 38, wherein the transmitter housing is removably coupled onto the communication apparatus by a two faced adhering system.

40. The system of claim 35, wherein the receiver housing comprises an in the ear receiver housing securable within the concha of the ear.

15 41. The system of claim 35, wherein the receiver housing comprises a behind the ear receiver housing securable by the pinna of the ear.

20 42. The system of claim 35, wherein the at least one audio port configured to receive an audio signal representative of received audio input from the communication apparatus comprises an audio port configured for wired connection to the audio port of the communication apparatus.

25 43. The system of claim 42, wherein the communication apparatus is a phone apparatus having a microphone/speaker audio port, and further wherein the audio port of the transmitter apparatus is configured for wired connection to the microphone/speaker audio port by a cord/plug connector apparatus.

30 44. The system of claim 35, wherein the size of the transmitter housing comprises a volume less than about 5 cm<sup>3</sup>.

45. A portable communication system for use by a user with a communication apparatus having an audio port, the system comprising:

a transmitter apparatus, wherein the transmitter apparatus comprises:

5 at least one audio port configured to receive an audio signal representative of received audio input from the communication apparatus via a wired connection with the audio port of the communication apparatus

modulation circuitry operable to convert the audio signal to one or more constant width electrical pulses to drive a transmitter to transmit one or more corresponding constant width pulses, and

10 a transmitter housing enclosing at least the modulation circuitry, wherein the transmitter housing is of a size smaller than the communication apparatus and configured to be removably coupled onto the communication apparatus; and

15 a receiver apparatus operable for communication with the transmitter apparatus, wherein the receiver apparatus comprises:

a detection device to detect the one or more corresponding constant width pulses and generate one or more electric signals representative of the detected pulses,

20 a speaker,

demodulation circuitry operable to convert the one or more electric signals representative of the detected pulses to an audio signal to power the speaker to produce a sound output, and

25 a receiver housing enclosing at least the speaker and the demodulation circuitry, wherein the receiver housing comprises an opening defined therein configured to receive a removable battery apparatus, and further wherein the receiver housing is formed to be self-supported by the ear of the user.

46. The system of claim 45, wherein the transmitter housing comprises means for removably attaching the transmitter housing to the communication apparatus.

47. The system of claim 45, wherein the receiver housing comprises an in the ear receiver housing securable within the concha of the ear.

5 48. The system of claim 45, wherein the receiver housing further includes a supporting ear hook extending therefrom.

49. The system of claim 45, wherein the modulation circuitry comprises:  
pulse width modulation circuitry to convert the audio signal using a carrier  
signal to one or more width modulated pulses, wherein the width of the one or more  
10 pulses is varied as a function of the audio signal;  
an edge detect circuit to detect the edges of the one or more width modulated  
pulses and generating constant width pulses based on the detected edges; and  
a pulse driver circuit to drive an RF transmitting device.

15 50. The system of claim 45, wherein the demodulation circuitry comprises:  
pulse detection circuitry to convert the one or more electrical signals  
representative of the detected pulses to one or more constant width pulses based  
thereon;  
pulse width convertor circuitry to convert the one or more constant width  
20 pulses to one or more width modulated pulses; and  
pulse width modulation circuitry to convert the one or more width modulated  
pulses to an audio signal for application to the speaker.

51. A portable transmitter apparatus for use by a user with a communication  
25 apparatus having an audio port, the apparatus comprising:  
at least one audio port configured to receive an audio signal representative of  
received audio input from the communication apparatus;  
modulation circuitry operable to convert the audio signal to one or more  
constant width electrical pulses to drive a transmitter to transmit one or more  
30 corresponding constant width pulses;

a microphone coupled to the at least one audio port of the transmitter apparatus and operable to generate an audio signal from received sound input of the user, wherein the audio signal generated from received sound input of the user is provided to the audio port of the communication apparatus via the audio port of the transmitter apparatus; and

a transmitter housing enclosing at least the modulation circuitry and the microphone, wherein the transmitter housing is of a size smaller than the communication apparatus and configured to be removably coupled onto the communication apparatus.

52. The apparatus of claim 51, wherein the microphone is coupled to the at least one audio port of the transmitter apparatus via an amplification circuit to provide the audio signal with a gain.

53. The apparatus of claim 52, wherein the gain is in the range of 2 to 20.

54. The apparatus of claim 51, wherein the transmitter housing comprises means for removably attaching the transmitter housing to a phone apparatus.

55. The apparatus of claim 51, wherein the modulation circuitry comprises:  
pulse width modulation circuitry to convert the audio signal using a carrier signal to one or more width modulated pulses, wherein the width of the one or more pulses is varied as a function of the audio signal;

an edge detect circuit to detect the edges of the one or more width modulated pulses and generating constant width pulses based on the detected edges; and  
a pulse driver circuit to drive an RF transmitting device.

56. The apparatus of claim 55, wherein modulation circuitry comprises voice activated power up circuitry.

57. The apparatus of claim 51, wherein the at least one audio port of the transmitter apparatus configured to receive an audio signal representative of received audio input from the communication apparatus comprises an audio port configured for wired connection to the audio port of the communication apparatus.

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58. The apparatus of claim 57, wherein the communication apparatus is a phone apparatus having a microphone/speaker audio port, and further wherein the audio port of the transmitter apparatus is configured for wired connection to the microphone/speaker audio port by a cord/plug connector apparatus.

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59. The apparatus of claim 51, wherein the size of the transmitter housing comprises a volume less than about 5 cm<sup>3</sup>.

60. The apparatus of claim 51, wherein the transmitter housing is configured with an opening to receive a removable battery apparatus.

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61. A portable receiver apparatus comprising:

a detection device to detect one or more pulses and generate one or more electrical signals representative of the detected pulses;

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a speaker;

demodulation circuitry operable to convert the one or more electrical signals representative of the detected pulses to an audio signal to power the speaker to produce a sound output, wherein the demodulation circuitry comprises:

25

pulse detection circuitry to convert the one or more electrical signals representative of the detected pulses to one or more constant width pulses based thereon,

pulse width convertor circuitry to convert the one or more constant width pulses to one or more width modulated pulses, and

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pulse width demodulation circuitry to convert the one or more width modulated pulses to the audio signal for application to the speaker, and

a housing enclosing at least the speaker and the demodulation circuitry,  
wherein the housing is formed to be self-supported by the ear of a user.

62. The apparatus of claim 61, wherein the housing comprises:

5 a body portion extending from a first end to a second end along a body  
portion axis to enclose at least a portion of the demodulation circuitry; and  
an ear retaining portion enclosing the speaker, wherein the ear retaining  
portion extends from the first end of the body portion along an axis of predominate  
sound direction of the speaker that is orthogonal to the body portion axis, wherein  
10 the ear retaining portion comprises a compactable and expandable material for  
insertion in the concha of the ear.

63. The apparatus of claim 62, wherein the body portion comprises at least one  
surface that lies a certain distance from the body portion axis in the direction of  
15 extension of the ear retention portion, and further wherein the compactable and  
expandable material of the ear retaining portion is positioned a further distance from  
the body portion axis than the at least one surface of the body portion.

64. The apparatus of claim 62, wherein the detection device comprises an the  
20 infrared light detection device positioned at the second end of the body portion to  
detect infrared pulses and generate the electrical signals representative of such  
detected infrared pulses.

65. The apparatus of claim 62, wherein the body portion comprises an opening  
25 defined therein configured to receive a removable battery apparatus.

66. The apparatus of claim 65, wherein at least one of the body portion and the  
removable battery apparatus comprises retaining structure to secure the removable  
battery apparatus in the opening.

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67. The apparatus of claim 62, wherein the removable battery apparatus is configured to receive one or more button type batteries.

5 68. The apparatus of claim 62, wherein a size of the body portion comprises a volume less than about 13 cm<sup>3</sup>.

69. A portable receiver apparatus comprising:  
an ear retaining portion enclosing a speaker, wherein the ear retaining portion terminates with a compactable and expandable material for insertion in the  
10 concha of an ear of a user; and  
a body portion extending from a first end to a second end along a body portion axis, wherein the ear retaining portion extends from the first end of the body portion along an axis of predominate sound direction of the speaker that is orthogonal to the body portion axis, wherein an infrared light detection device is  
15 positioned at the second end of the body portion to detect infrared pulses and generate one or more electrical signals representative of such detected infrared pulses, and further wherein the body portion encloses at least demodulation circuitry operable to convert the one or more electrical signals representative of the detected infrared pulses to an audio signal to power the speaker to produce a sound output,  
20 wherein the demodulation circuitry comprises:  
pulse detection circuitry to convert the one or more electrical signals representative of the detected infrared pulses to one or more constant width pulses based thereon,  
pulse width convertor circuitry to convert the one or more constant  
25 width pulses to one or more width modulated pulses, and  
pulse width demodulation circuitry to convert the one or more width modulated pulses to an audio signal for application to the speaker.

70. The apparatus of claim 69, wherein the body portion comprises at least one  
30 surface that lies a certain distance from the body portion axis in the direction of

extension of the ear retention portion, and further wherein the compactable and expandable material of the ear retaining portion is positioned a further distance from the body portion axis than the at least one surface of the body portion.

5        71.     The apparatus of claim 69, wherein the body portion comprises an opening defined therein configured to receive a removable battery apparatus.

72.     The apparatus of claim 71, wherein at least one of the body portion and the removable battery apparatus comprises retaining structure to secure the battery  
10        apparatus in the opening.

73.     The apparatus of claim 71, wherein the removable battery apparatus is configured to receive one or more button type batteries.

15        74.     The apparatus of claim 69, wherein the size of the body portion comprises a volume less than about 13 cm<sup>3</sup>.

75.     A portable receiver apparatus comprising:  
         ear retaining means for enclosing a speaker and configured for insertion in  
20        the concha of an ear of a user;  
         infrared light detection means for detecting infrared pulses and generating one or more electrical signals representative of such detected infrared pulses; and  
         body portion means for enclosing at least demodulation means for  
         converting the one or more electrical signals representative of the detected infrared  
25        pulses to an audio signal to power the speaker to produce a sound output, the body portion means extending from a first end to a second end along a body portion axis, wherein the ear retaining means extends from the first end of the body portion along an axis of predominate sound direction of the speaker that is orthogonal to the body portion axis and further wherein the infrared light detection means is positioned at  
30        the second end of the body portion means.



76. The apparatus of claim 75, wherein the body portion means comprises means for receiving a removable battery apparatus.

5 77. The apparatus of claim 76, wherein at least one of the body portion means and the removable battery apparatus comprises retaining means to secure the battery apparatus in the body portion means.

78. The apparatus of claim 75, wherein a size of the body portion means is of a volume less than about 13 cm<sup>3</sup>.

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